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FUEL INJECTION DIRECTION VARIABLE TYPE DIESEL ENGINE
[Nenryo funsha hoko kahenshiki deizeru kikan]

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FUEL INJECTION DIRECTION VARIABLE TYPE DIESEL ENGINE

[Nenryo funsha hoko kahenshiki deizeru kikan]

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[There are no amendments to this patent.

Claims

1. A fuel injection direction variable type diesel engine characterized by the fact that the angle of mounting of the fuel injection valve on the cylinder cover is variable in the structure.

2. The fuel injection direction variable type diesel engine described in Claim 1 characterized by the fact that the holding face of the fuel injection valve and the cylinder cover and the joint face of the fuel feeding pipe and said fuel injection valve are made of first and second spherical surfaces around the same point as the center.

3. The fuel injection direction variable type diesel engine described in Claim 1 or 2 characterized by the fact that it has a fuel injection valve mounting angle indicator.

Detailed explanation of the invention

Industrial application field

The present invention pertains to a fuel injection direction variable type diesel engine.

Prior art

First, an explanation will be given regarding fuel injection in the diesel engine. Figure 2 is a diagram illustrating the uni-flow gas sweeping type diesel engine in the prior art. (1) represents a cylinder liner; (2) represents a piston; (3) represents a cylinder cover; and (4) represents an exhausting valve. (5) represents a combustion chamber formed surrounding them. Atomizer (7) of fuel injection valve (6) is attached to cylinder cover (3) facing [the combustion chamber (5)]. Fuel (8) fed under pressure to fuel injection valve (6) from a fuel pump not shown in the figure is injected from injecting holes (9) formed on atomizer (7) shown in Figure 3, and it becomes mist (10) shown in Figure 2.

Figure 4 is a diagram illustrating the attachment structure on cylinder cover (3) of fuel injection valve (6) shown in Figure 1. For fuel injection valve (6) with atomizer (7) protruding on its tip, as flange portion (11) is fastened by bolts (12), holder (13) is fixed on cylinder cover (3). In this state, said atomizer (7) faces combustion chamber (5). Said fuel (8) is fed from high pressure pipe (14) via joint (15) to fuel injection valve (6), and it is injected from injecting holes (9) to form mist (10).

Figure 6 is a diagram illustrating the injection pattern from fuel injection valve (6). Figure 6(a) shows the main portion of the same cross-section as that in Figure 2. Figure 6(b) is a cross-sectional view taken across [line] Z-Z in Figure 6(a). Figure 6(c) is a cross-sectional view illustrating a cross-sectional view taken across X-X. Figure 6(a) is a cross-sectional view taken across Y-Y in Figure 6(b). Here, fuel injection valve (6) is of the type depending on the type of the diesel engine. Usually, a plurality of them are set as shown in Figure 6(b), and the various valves (6) inject fuel simultaneously.

As shown in Figures 6(a), (b), the injection directions of the fuel are different for the various injecting holes (9). In order to display the direction, in the following, the angle from the plane perpendicular to cylinder axis (16) is taken as θi, and the angle from the plane connecting fuel injection valve (6) and cylinder axis (16) is taken as αi. Also, the average value of θi and αi with respect to number n of the injection holes are as follows: $\bar{\theta} = \sum_{i=1}^{n} \theta_i / n$, $\bar{\alpha} = \sum_{i=1}^{n} \alpha_i / n$. Figure 6(c) is a diagram illustrating the position of each mist (10) in combustion chamber (5). In the following, the position of mist (10) will be represented in the form shown in Figure 6(c).

For example, as mist portions (10) from injecting holes (9) approach each other, mixing with air becomes poor, and it takes a longer time for combustion, so that the fuel consumption rate deteriorates. Also, as mist (10) approaches the wall of the combustion chamber, the temperature of the wall member rises, and heat damage and other problems take place. Here, fuel injection direction θi, αi are set in consideration of the aforementioned combustibility, thermal load, etc. However, due to the influence of the sweeping gas vortex (swirl), etc., it is difficult to set the determining conditions.

Figures 7 and 8 show variation in the fuel costs b_e when θi • αi shown in Figure 6 varies systematically due to exchange of atomizer as determined by the present inventors. It can be seen that there exists the optimum value of θ[bar] • α[bar] for each output power of the engine. In practice, when one of θ[bar] • α[bar] is changed, the other also makes a certain variation along with it. In the figure, the arrow indicates the point where the fuel costs b_e become the smallest is shown. In the case

shown in Figure 7, the higher the load, the larger the value of θ[bar] (in the direction where mist (10) is nearer to piston (2) as shown in Figure 6(a)) where the minimum value of be takes place. Also, as θ[bar] becomes larger, as shown in Figure 2, mist (10) becomes farther from exhausting valve (4), there is a tendency that the temperature of exhausting valve (4) without cooling falls, and this is favorable from the viewpoint of the thermal load.

In this way, when the injecting direction of fuel varies corresponding to the output condition, it is effective to reduce the fuel costs and the thermal load.

In the prior art, the injection direction of the fuel injection valve is changed by adopting the double structure of atomizer (17) as shown in Figure 5. While its outer cylinder (18) is fixed, its inner cylinder (19) is made rotatable, so that the direction of injecting hole (9) can be changed.

Problems to be solved by the invention

However, for the prior art shown in Figure 5, it is difficult to form a complicated structure of small size atomizer (17) while said α[bar] is changed alone. Also, sliding between outer cylinder (18) exposed to the combustion gas and inner cylinder (19) is problematic.

The purpose of the present invention is to change the injecting direction without adjusting the atomizer.

Means to solve the problems

In order to solve the aforementioned problem, the present invention provides a constitution characterized by the fact that the attachment angle of the fuel injection valve on the cylinder cover is made variable.

Operation

With said constitution, the overall fuel injection valve is moved to change the fuel injecting direction, so that it is possible to change the fuel injection direction without performing exchange or adjustment of the atomizer, that is, without disassembling the fuel injection valve.

Application examples

In the following, the present invention will be explained in more detail with reference to an application example. As shown in Figure 1, holding face (23) of the tip of holder (22) of fuel injection valve (21) and cylinder cover (3) forms the first spherical surface around point (A) on the central axis of fuel injection valve (21) at the center. Also, on the tip of high pressure pipe (24), pipe-side flange (25) is formed, and at the same time, valve-side flange (26) is formed on the portion of holder (22) corresponding to it. Also, joint face (27) between said pipe-side flange (25) and valve-side flange (26) forms the second spherical surface around said point (A) at the center.

As fuel injection valve (21) can rotate around point (A) at the center, on cylinder cover (3), conical spaces (28), (29) are formed for the movement of holder (22) and atomizer (7). Also, on said two flanges (25), (26), fuel path expanding portions (30), (31) in semi-spherical shape are formed so as to absorb the movement of said holder (22). (32) represents O-rings for

sealing said fuel path expanding portions (30), (31). They are of the size that can cope with the operation range (indicated by broken line in the figure) of fuel path expanding portion (31) on the side of holder (22).

(33) represents a fixture of fuel injection valve (21). It has fixing flange (34) fitting on pipe-side flange (25) formed monolithically, and it is mounted by bolts (35) on cylinder cover (3). (36) represents a shim for adjusting the height of fixing flange (34). Also, on fixture (33) and holder (22), needles (37), (38) are attached to form attachment angle indicator (39) of fuel injection valve (21).

With this constitution, fuel injection valve (21) can rotate freely around point (A) at the center. As a result, the fuel injecting direction, that is, said θ[bar] • α[bar], can be changed at will. As a result, it is possible to set the fuel injection direction to the optimum direction corresponding to the output condition of the engine, and it is possible to minimize the fuel costs and to reduce the thermal load. Also, when the injecting direction is to be changed, one may simply move holder (22), and there is no need to perform exchange and adjustment of atomizer (7) as would be needed in the prior art. As a result, it is possible to adjust the injecting direction easily without disassembling fuel injection valve (21). In addition, by means of attachment angle indicator (39), it is possible to read the set injecting direction easily.

Effect of the invention

As explained above, according to the present invention, by moving the overall fuel injection valve, it is possible to change the fuel injection direction, so that it is possible to change the fuel injection direction without disassembling the fuel injection valve to perform exchange or adjustment of the atomizer.

<u>Detailed description of the figures</u>

Figure 1 is a cross-sectional view illustrating an application example of the present invention. Figure 2 is a cross-sectional view illustrating the diesel engine in the prior art. Figure 3 is an enlarged view of the main portion of the atomizer in Figure 2. Figure 4 is a diagram illustrating the attachment structure of the fuel injection valve shown in Figure 2. Figure 5 is an oblique view of the fuel injecting direction changing mechanism in the prior art. Figure 6 is a diagram illustrating the injecting pattern. Figure 7 is a diagram illustrating variation in the fuel costs when θ[bar] is changed. Figure 8 is a diagram illustrating variation in the fuel costs when α[bar] is changed.

3 Cylinder cover
7 Atomizer
21 Fuel i njection valve
22 Holder
23 Holding face
A Point
27 Joint face
33 Fixt ure
39 Attac hment angle indicator

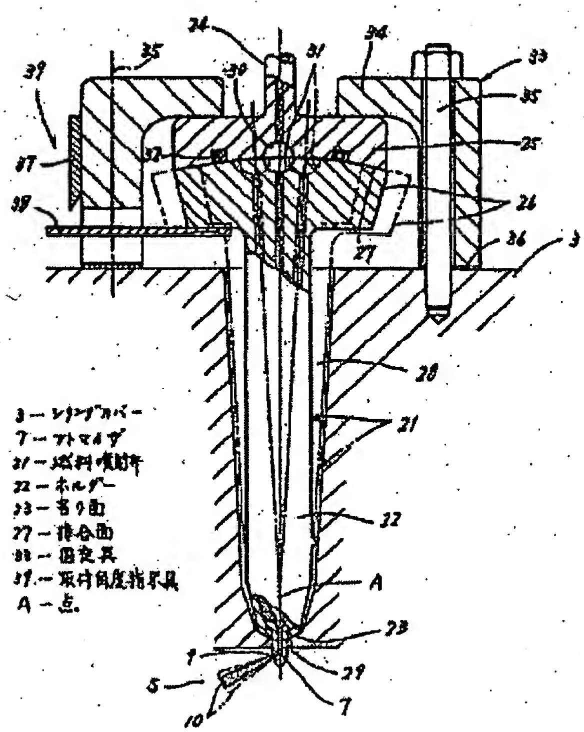

Figure 1

Legend:

3	Cylinder cover
7	Atomizer
21	Fuel injection valve
22	Holder
23	Holding face
27	Joint face
33	Fixture
39	Attachment angle indicator
A	Point

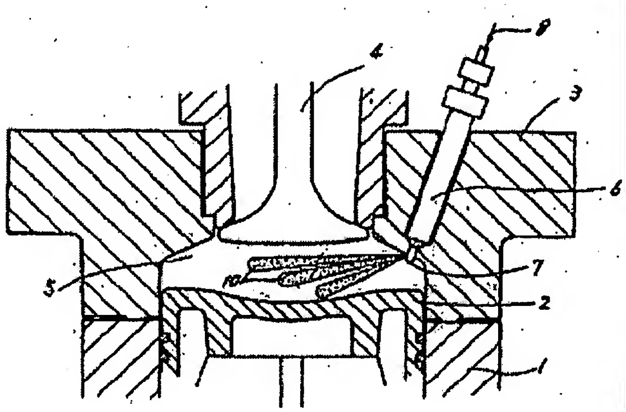

Figure 2

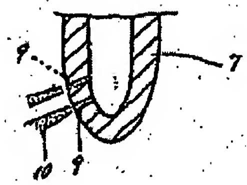

Figure 3

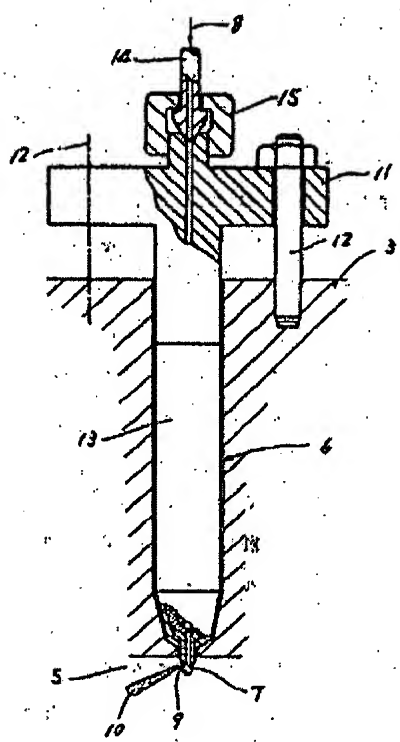

Figure 4

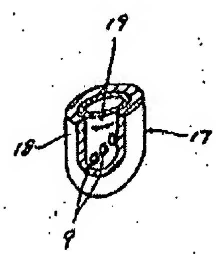

Figure 5

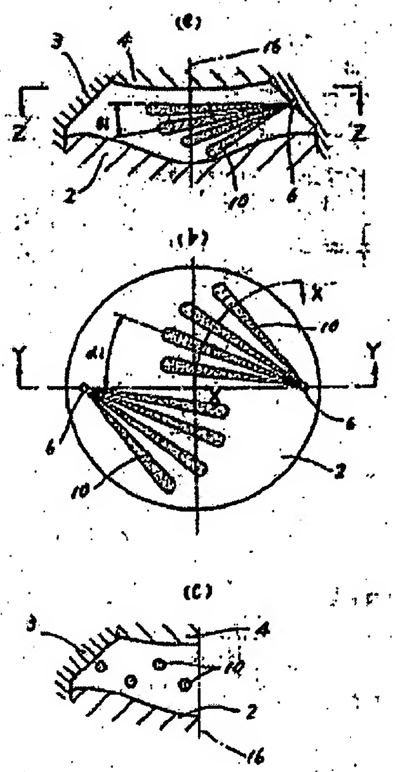

Figure 6

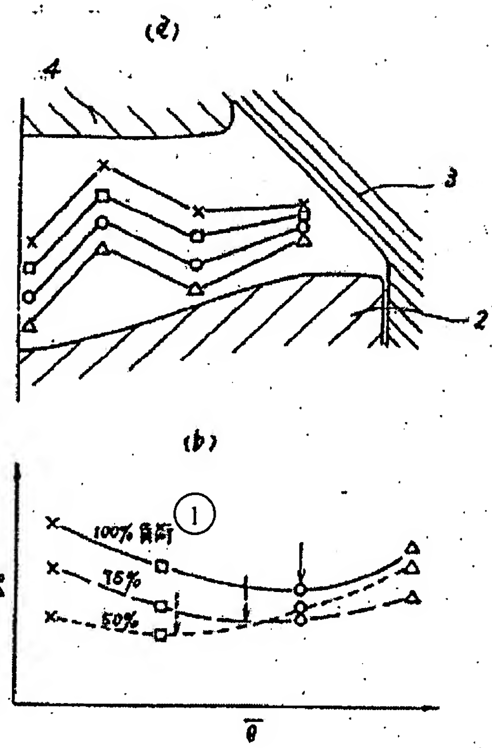

Figure 7

Key: 1 Load

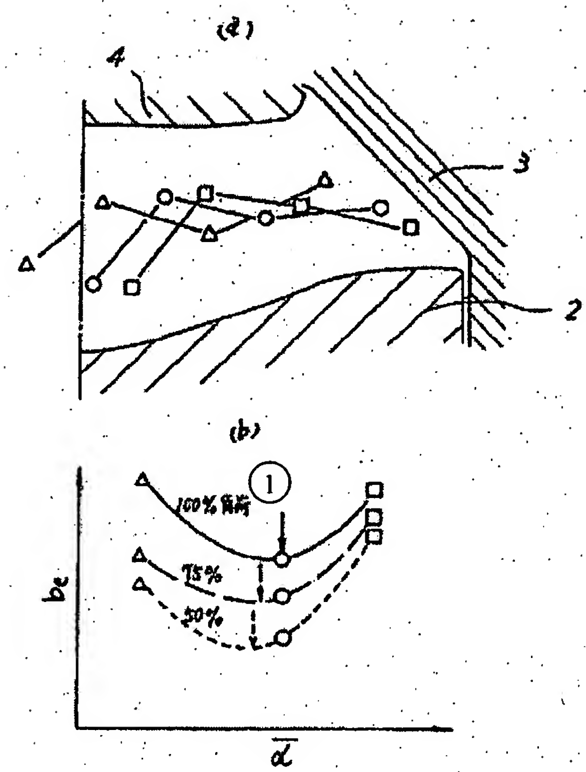

Figure 8

Key: 1 Load